

# The Socio-economic Effect of the Reform of the Collective Forest Rights System in Southern China: A Case of Tonggu County, Jiangxi Province

Changhai Wang · Yali Wen · Jing Wu

Accepted: 17 February 2014 / Published online: 23 February 2014  
© Steve Harrison, John Herbohn 2014

**Abstract** This paper analyzes the impacts made by reform of the collective forest rights system (RCFRS) on household livelihoods in southern China from 2005 to 2012. A case study was conducted of households mainly in Tonggu County, Jiangxi. The main focus was to obtain basic data about the change in households livelihoods from 2005 to 2012. Following the sustainable livelihood framework, the research subjects were divided into two groups based on income level to identify and confirm the livelihood impacts and changes brought about by the RCFRS. It was found that the RCFRS policy did indeed influence the capital assets, the strategies and the overall quality of life of both low-income and high-income households. Changes in access to capital assets remain unbalanced, especially considering the rapid pace of financial capital changes. The primary means of earning a living in the pilot program areas is still agriculture, while for those households, the best way to obtain capital is by working away from their home town. While 76 % of households are satisfied with their current living situation and are willing to participate in the program continuously, only 59 % of the households from the low-income group said they would continue participating in the program. Therefore, this research suggests that the government should further adjust its compensation policy and

---

**Electronic supplementary material** The online version of this article (doi:[10.1007/s11842-014-9263-9](https://doi.org/10.1007/s11842-014-9263-9)) contains supplementary material, which is available to authorized users.

---

C. Wang (✉)

Rural Development Institute, Chinese Academy of Social Sciences, Beijing 100732, China  
e-mail: casswch@163.com

C. Wang

Collaborative Innovation Center for Rural Reform and Development, Beijing 100732, China

Y. Wen · J. Wu

School of Economics and Management, Beijing Forestry University, Beijing 100083, China

improve the social security mechanisms, which would in turn further consolidate the achievements of the RCFRS.

**Keywords** Forestry management reform · Livelihood change · Income groups · Sustainable livelihood framework

## Introduction

Poverty and environmental degradation are two of the main difficulties many developing countries currently face (Carney et al. 1999; Barbier 2000). With the Chinese economy developing so rapidly, the resources and ecological problems in the rural area of southern China have become increasingly evident since 1978. The government of China and academics always seem to concern themselves with such issues as how to improve the people's living standards, preserve the local ecological environment and promote the sustainable development of rural areas. Reform of the collective forest right system (RCFRS) is a major policy decided upon by the government to improve people's living standards and the natural environment, and for the most part, the RCFRS has progressed smoothly. The achievements made since the RCFRS was put into effect in 2005 are evident (Yin et al. 2010). While the ecological environment in southern China has been greatly improved, a number of households in program areas are faced with several additional problems, including restricted development of their agriculture and forestry projects and the corresponding reduction in sources of income. These negative factors limit the overall acceptance and benefits of the program and could even threaten the survival and development of those households (Adikhari et al. 2004; Xu et al. 2006; Wang et al. 2010). Therefore, the characteristics and current situation of the relevant households' livelihoods were examined to make sure the program can increase their income and protect their ecological environment.

Research into the impacts of the RCFRS on household livelihoods has important practical ramifications, because the households themselves are the participants in this program. By taking households' vital interests into consideration, the RCFRS encourages the households' mobility. It is this mobility which could enhance the effectiveness of the program. However, owing to the limitations of economic compensation and the slow recovery of the ecological environment in the RCFRS area, it appears necessary to make feasible plans based more on the criteria the households themselves would be willing to accept (Chen et al. 2012; Cronkleton et al. 2012; Maryudi et al. 2012). Otherwise, a situation could develop of attempting to grow forests while at the same time forests are destroyed. The response to the compensation policy has been a major indicator of the households' willingness to participate in the RCFRS, which in turn was the main basis for judging the rationale behind the enforcement of the program in any given region, or even in a whole nation. The objective of the RCFRS was to find a combination of means to solve the contradictions between the compensation policy, the policy response and the ecological economics construction. However, the researchers (Chen et al. 2012;

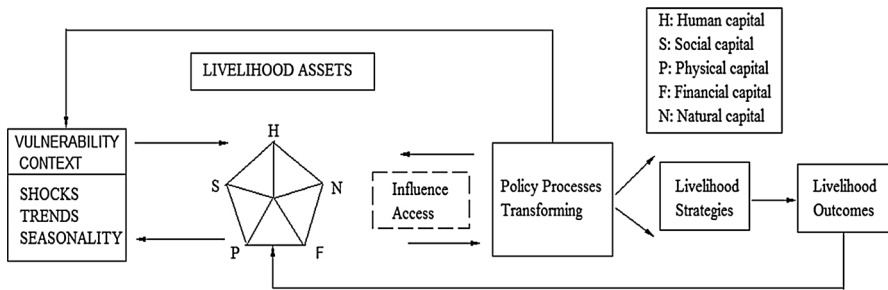
Cronkleton et al. 2012; Maryudi et al. 2012) adopted various methods, which led to obtaining contradictory data and ultimately reaching different conclusions.

While some researchers generally thought the program brought significant economic benefits, most of them thought the RCFRS had limited influence on income growth or any benefit to the area's overall economic structure (Ali et al. 2007; Schموok and Radel 2008; Pandit et al. 2009). There was also a question as to whether the RCFRS lead to any phased influence on household incomes (Xu et al. 2006; Wang et al. 2013). Therefore, it is difficult to find any means to comprehensively and objectively judge the influence of the RCFRS in a manner which could supply scientific evidence that would assist in perfecting the policy in the next phase. The RCFRS, as a representative ecological and economic forestry project, should focus on not only protecting the fragile eco-environment, but also mainly on alleviating poverty (Illukpitiya and Yanagida 2008; Dai et al. 2009). In the long-term, the impact of this program on the social and economic conditions and eco-environment is of great importance. The research conducted to date still lacks comparative study (contrast of different time and groups), though it could draw on comprehensive data from the previous research which were the basis of the study. Especially the sustainable livelihood method is widely used in the study of poverty and rural development rarely applied in the study of the households in the program area.

In this research, by means of multivariate analysis and a sustainable livelihood framework (SLF) (Fig. 1), survey data and data obtained by monitoring household lifestyles in both 2005 and 2012 have been analyzed to determine the program's impacts. This paper covers the research into the following aspects of the RCFRS: Objective I: Analyze the changes in livelihood (means of making a living) and capital assets of income groups (high-income and low-income), and analyze the five livelihood and capital asset classes quantitatively, in the context of the SLF. Objective II: Analyze changes in the household livelihood strategies due to the program, and the various outcomes for the income groups.

## The Study Area

The research was carried out in Tonggu County (28°32'–28°50'N, and 114°05'–114°44'E), Jiangxi Province, in China. Tonggu County lies mainly in the northern temperate zone which falls under the influence of seasonal monsoons. It has a continental climate. It is a fragile region, ecologically speaking, which is vulnerable to natural disasters. The land in this county is distributed between mountainous and hilly areas, with the altitude ranging from 155 to 1,688 masl. County forest coverage rate reached 86.42 % in 2011. As the key county participating in the RCFRS, this area was chosen as the primary subject of the research, which was conducted with the support of the local government. The county has a population of 105,000, mostly living in nine rural towns and 104 incorporated villages. By the end of 2011, about 70 % of the population in rural areas had been influenced by the current RCFRS in Tonggu County. The forest area takes up 87.9 % of the total land area in this County. Forestry has always played an important role in developing the local economy, and it is the main source of income for the households.



**Fig. 1** sustainable livelihood framework (SLF) by the UK's Department for International Development (Scoones 1998)

## Research Method

The sustainable livelihood framework (SLF) as described by the UK Department for International Development (DFID) (Scoones 1998) was adopted to examine household livelihood changes, including changes of capital, strategies. The livelihood changes were analyzed quantitatively by applying SLF, and a certain highlight was obtained for the research of RCFRS. The research vertically monitored changes of livelihood capital assets of the same households which participated in the surveys in both 2005 and 2012, and horizontally compared the changes of livelihood activities of these two groups. According to the reality of China's regional economic development, the quantitative score was redefined to measure the changes of livelihood capital asset by applying the SLF. Thus the research introduced the score definition (see Supplementary Materials, Tables 1 and 2) to measure the livelihood capital index based on SLF relevant research (Knutsson and Ostwald 2006; Mahdi and Schmidt-Vogt 2009; Chen et al. 2012) and the reality of the program area.

## Data Collection

Rapid rural appraisals (RRAs) and household surveys were carried out in seven villages of Tonggu County. Samples were selected using multi-stage and cluster sampling. Firstly, based on the specific natural environment required to conduct the research, four towns were chosen from the key mountain area, largely for the purposes of studying household livelihoods and attitudes to environmental protection. Based on the levels of economic development, geological conditions and the household actual participation situation for the RCFRS, one to three villages were randomly selected from the chosen towns, while at the same time taking household livelihood types and the population size into consideration. A total of seven villages were selected, namely Sanxi Village, Gaopi Village, Yongqing Village, Dacao Village, Shuangxi Village, Damei Village, Yongfeng Village. A total of 682 households was selected randomly in the chosen villages.

A questionnaire was developed, containing questions on livelihood capital assets, livelihood strategy and livelihood outcomes. Livelihood capital assets included

**Table 1** Demographic characteristics of respondents

Number of respondents		
Demography of respondents	2005 (N = 256)	2012 (N = 337)
Gender		
Male	207 (81 %)	229 (68 %)
Female	49 (19 %)	108 (32 %)
Age		
a < 30	29 (11 %)	12 (4 %)
30 ≤ a ≤ 40	87 (34 %)	39 (12 %)
40 < a < 55	101 (39 %)	209 (62 %)
a ≥ 55	39 (15 %)	77 (23 %)
School education level		
Illiterate	13 (5 %)	5 (1 %)
Primary school (≤6 years)	145 (57 %)	131 (39 %)
Junior middle school (7–9years)	74 (29 %)	147 (44 %)
Senior high school (≥10 years)	24 (9 %)	54 (16 %)
Work type		
Farming	156 (61 %)	136 (40 %)
Work outside the village	58 (23 %)	135 (40 %)
Other work types	42 (16 %)	67 (20 %)
Income level		
High income group	107 (42 %)	253 (75 %)
Low income group	149 (58 %)	84 (25 %)

N signifies the number of valid sample; the number in the bracket is the percentage of the households

natural capital, physical capital, human capital, financial capital and social capital. Interviews were conducted in public areas of the selected communities; the research also included semi-structured interviews. Investigators visited 312 households during July, 2005, and returned 278 finished questionnaires, of which 256 were valid. The investigators distributed the questionnaires with only minor revisions in the same villages during July 2012, obtaining 358 completed questionnaires, of which 337 were valid. The questionnaires were numbered by combining the name of the village with the name of the head of the household, for example, Sanxi village-Wang tao-01, Sanxi village-Zhang yunhai-02.

### Data analysis

The score definition was introduced to measure the livelihood capital index based on SLF-correlated research, as well as the socioeconomic development reality of the program area. Two statistical analyses were carried out. The households were divided into two groups after initially checking the questionnaires: the high-income group and the low-income group. First, t tests were conducted to examine whether differences existed in access to the five pre-defined livelihood capital asset classes

**Table 2** The change in livelihood capital asset of high income group and low income group in 2005 and 2012

Capital asset class and individual variables	Year	High income group (more than average income)		Low income group (less than average income)		P	Total groups	
		Average score of index	t values	Average score of index	t values		Average score of index	t values
1 Natural capital asset	2005	0.552	-27.462*	0.562	11.793	NS	0.546	9.411
	2012	0.464		0.505		NS	0.495	
Forestland area ( $\mu$ )	2005	0.566	12.994	0.543	30.918*	NS	0.534	18.902*
	2012	0.603		0.652		NS	0.641	
Farmland area ( $\mu$ )	2005	0.538	-45.944*	0.580	-30.191*	NS	0.557	-17.635*
	2012	0.324		0.357		NS	0.349	
2 Human capital asset	2005	0.639	0.578	0.565	3.467	NS	0.614	1.555
	2012	0.654		0.618		NS	0.642	
Working-age labour	2005	0.611	0.229	0.638	-3.505	NS	0.624	-2.141
	2012	0.629		0.582		NS	0.590	
Education level	2005	0.527	17.983*	0.384	19.355*	0.001	0.463	15.505*
	2012	0.638		0.510		0.05	0.593	
Health condition	2005	0.778	9.341	0.673	13.746*	0.05	0.756	0.991
	2012	0.695		0.762		0.10	0.744	
3 Physical capital asset	2005	0.679	15.113*	0.479	29.360*	0.001	0.523	25.109*
	2012	0.733		0.560		0.05	0.630	
Home equity	2005	0.739	19.325*	0.436	49.036*	0.001	0.523	24.414*
	2012	0.827		0.666		0.001	0.719	
Livestock	2005	0.758	-70.689*	0.811	-45.333*	NS	0.798	-63.817*
	2012	0.361		0.412		0.001	0.403	

Table 2 continued

Capital asset class and individual variables	Year	High income group (more than average income)		Low income group (less than average income)		P	Total groups	
		Average score of index	t values	Average score of index	t values		Average score of index	t values
Durables	2005	0.542	53.551*	0.306	61.386*	0.05	0.336	50.864*
	2012	0.858		0.593		0.001	0.630	
Vehicles	2005	0.675	41.307*	0.363	40.161*	0.001	0.434	69.369*
	2012	0.887		0.569		0.001	0.766	
4 Financial capital asset	2005	0.519	33.365*	0.301	32.459*	0.001	0.378	29.782*
	2012	0.832		0.579		0.001	0.663	
Net per capita income	2005	0.476	65.789*	0.331	41.937*	0.05	0.347	25.300*
	2012	0.846		0.560		0.001	0.623	
Total income	2005	0.516	37.824*	0.340	23.338*	0.001	0.439	27.505*
	2012	0.776		0.572		0.001	0.678	
Savings	2005	0.512	26.372*	0.336	20.131*	0.001	0.410	17.334*
	2012	0.800		0.521		0.001	0.566	
Liabilities	2005	0.573	46.304*	0.195	64.969*	0.001	0.316	51.376*
	2012	0.907		0.663		0.001	0.783	
5 Social capital asset	2005	0.407	11.773*	0.371	9.632*	NS	0.384	14.863*
	2012	0.530		0.490		NS	0.507	
Community participation(S1)	2005	0.200	8.154*	0.369	21.904*	0.05	0.250	37.523*
	2012	0.315		0.643		0.001	0.568	
Contribution of funds (S2)	2005	0.448	13.691*	0.479	27.881*	NS	0.469	23.801*
	2012	0.621		0.756		0.1	0.695	

**Table 2** continued

Capital asset class and individual variables	Year	High income group (more than average income)		Low income group (less than average income)		<i>P</i>	Total groups	
		Average score of index	<i>t</i> values	Average score of index	<i>t</i> values		Average score of index	<i>t</i> values
Food supply (S3)	2005	0.491	5.363*	0.539	0.028	NS	0.520	3.693
	2012	0.593		0.543		NS	0.560	
Village cadres (S4)	2005	0.236	-2.119	0.027	0.171	0.001	0.085	1.761
	2012	0.176		0.002		0.001	0.091	
Monthly communication fees (yuan/household/month) (S5)	2005	0.466	36.675*	0.112	33.781*	0.001	0.302	27.312*
	2012	0.784		0.486		0.001	0.553	
Average social life cost (yuan/household/year) (S6)	2005	0.603	4.992*	0.698	-14.294*	NS	0.675	-8.664*
	2012	0.689		0.511		0.05	0.593	

\* Significant at the 5 % level; \*\* significant at the 1 % level

among households from the two income groups, and to initially determine if the reform policy aimed at households with affluent capital assets was successful. Second, a one-way analysis of variance (ANOVA) was conducted to examine the differences in the  $P$  value of livelihood changes between 2005 and 2012 among households from both income groups, and also to firstly determine if the households had changed their means of earning a living and their lifestyles due to the implementation of the reform project.

## Results

### Demographic Characteristics of Respondents

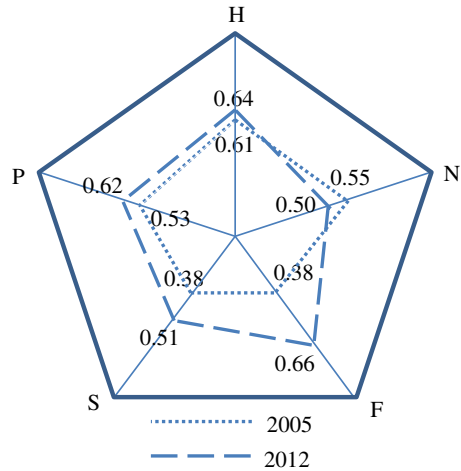
The demography of the respondents including gender, age, school education level, work types and income level is listed in Table 1. About 81 % of the respondents were male in 2005, much higher than 68 % in 2012. While 73 % of the respondents in 2005 were aged from 30 to 55, 86 % of them were middle-aged, defined as 30 to 40 years of age. This was because in 2005 the young and the middle-aged stayed home to do the farming without access to off-farm work; however, almost all went to work outside the village 7 years later upon the impacts of the RCFRS. With respect to the education level of respondents in 2005, 57 % of the respondents had completed or attended part of primary education, while 29 % of other respondents had taken the new opportunity to have a junior middle school education. In 2012, the proportion of respondents who have primary education, secondary education and university education were 39, 44 and 16 %; However, only 1 % of the respondents had no education. From the above, the conclusion can be arrived at that more and more families focused on education. With respect to the work types, the proportion of farming households decreased from 2005 (61 %) to 2012 (40 %), while the proportion of the households who went to work outside the village increased (from 23 % to 40 %). With respect to income level, 42 % households in 2005 were in the high-income group, and by 2012 the proportion had increased to 75 %.

### Changes in Household Livelihoods

#### *Changes in Access to Capital Assets*

According to the fundamental theory of SLF, the asset pentagon should be a regular pentagon when the contribution of five kinds of livelihood capital assets reaches an ideal equilibrium state (Blaikie 2006; Grischow 2008; Mahdi and Schmidt-Vogt 2009). In fact, households could not obtain all the livelihood capital assets, because some of those assets are inaccessible, especially in poverty-stricken areas particularly lacking in some of those assets (Mahdi and Schmidt-Vogt 2009). As indicated in Fig. 2, access to financial and social capital assets increased substantially between 2005 and 2012, while access to physical and human capital assets increased only slightly. During the same period, however, access to natural capital assets decreased slightly. While access to forest land has increased, access to farmland decreased

**Fig. 2** The change of livelihood human, natural, financial, social and physical capital assets of households in the research area in Tonggu County from 2005 to 2012



during the same period. Access to education level increased substantially, though the percentage of working-age labourers and their health status changed little. The capital assets of home equity, durables and vehicles in the physical capital index increased during the last 7 years, except those pertaining to livestock capital. Financial capital access increased substantially, which was one of the major objectives of the RCFRS. Access to some social capital classes has increased, including community participation, capital support and communication fees. However, food supply and the village cadres capital were both relatively constant.

Table 2 reports the results of the data analysis. All these results indicate that the RCFRS has positively influenced households' livelihood capital, but at the same time led to the failure to properly utilize some natural resources, including timber, other forest products and wild plants. Thus, the households lost the chance to transform those natural resources into financial capital gains for their members. At the same time, they failed to obtain their natural capital assets due to natural disasters (including debris moves and flooding). Therefore, their lifestyle and product processing methods have changed, as well as their livelihood strategy. Households not only planted crops, but also worked in the cities and grasped every opportunity to obtain suitable employment, and it has been these actions which have changed their financial capital assets. In turn, increased financial assets led to a major change in households' social assets, due to the indirect impact on households' social status, management participation and decision-making activities.

In the natural capital index, access to cropland has decreased substantially for both income groups. There has been little increase in access to forest land in the high-income group; however, poor households had more access to forest land in 2012 than in 2005. The fact is that Tonggu County had a succession of natural disasters, such as debris moves, which destroyed a lot of its forest land. It is likely that this situation has resulted in a significant change in households' acquisition of forest land. In the human capital index, most of the building variables changed only very slightly between 2005 and 2012. While access to education has increased

significantly between the two groups, the main reason for this increase is the households' increased income and the increase of government contributions of capital for education purposes. On the other hand, the health situation of the high-income group has improved, but not as significant ( $P > 0.05$ ) as for the low-income group. This improvement can be explained by higher quality infrastructure in the low-income areas. Also, due to the enforcement of the family-planning policy and the relative poverty, the population in the RCFRS area actually declined, which could account for the non-significant decrease in the percentage of adult labourers. In the physical capital index, while access to livestock assets has decreased significantly, other building variables increased significantly between the two groups, including home equity, durables assets and ownership of domestic vehicles. The reason for this trend is likely the management of local government which provided funding and technical guidance.

When examined using the ANOVA (Table 2), the high-income group's resources were increased to a larger extent than those of the low-income group in terms of their access to home equity, durable assets and vehicle assets ( $P < 0.001$ ). Therefore, the majority of the households received benefits in terms of physical capital assets, with the high-income group receiving proportionally more than the low-income group, thereby triggering a chain reaction (someone who already had a larger material base could have their income increase at a far more rapid rate, which made it easier to acquire more assets). In a word, through the socioeconomic development, the households' increased income is not only their foundation for survival on a daily basis, but increased income also forms the basis of the sustainable development of the RCFRS. In this research, the high-income group's assets had increased more than those of the low-income group in terms of access to all the building variables ( $P < 0.001$ ) and physical capital assets. From 2005 to 2012, the financial capital assets of the low-income group increased substantially, as was also the case with the high-income group.

Most households were unwilling to talk about their specific liabilities. The status of their liabilities was examined through the perception survey and set an evaluation score (see Supplementary Materials, Table 1). Generally speaking, households were optimistic with regard to their current liabilities, though a number of those in debt felt they were under repayment pressure. With respect to social capital assets, the difference in change in index of the two groups between 2005 and 2012 was not significant ( $P > 0.10$ ), even though every building variable in the two groups changed significantly, except for village cadres' capital assets. This research, especially in 2012, has revealed that most of the village cadres came from the high-income group. This was the reason why the selection mechanism of the village cadres showed a continuing state of imperfection, and the substances were used as the basis of the distribution of power. Otherwise, because most of those living in low-income households went outside the village to find a better job, there was less money left behind which could be called upon for personal favours in 2012 than in 2005. The old people and children left behind were no longer as enthusiastic about relationships as they were 7 years ago.

### *Changes in Livelihood Strategy*

Surplus rural labour has changed the livelihood strategy since the enforcement of the RCFRS. In this research, an analysis of livelihood strategies revealed three major elements to be considered: type of work, working hours and the formulation and implementation of strategies to cope with unexpected natural disasters (Table 3). From 2005 to 2012, the percentage of households in the high-income group who merely worked in agriculture decreased from 57 to 38 %, while the percentage of those who went to work in the city increased from 29 to 42 %. Other types of work were identified as setting up businesses, such as planning rural tourism (also called *Nongjiale* in China), and setting up a small supermarket in the village. The percentage of those who entered these types of employment also increased from 14 to 20 %. In addition, the households in the low-income group showed the same trends as those in high-income groups in terms of livelihood strategies having changed significantly.

There has been a decreasing trend for farming households to derive incomes solely from agriculture over the last 7 years, while the number of non-farming households and migrant workers has increased. With respect to working hours, off-farm households in both high and low-income groups spent less time doing work in the city than doing farming work in 2005, but more in 2012. In terms of the perceptions of strategies to cope with natural disasters, households in the high-income group showed a significant change from 2005 to 2012. They had the economic capability to cope with unforeseen natural disasters when they had ever-increasing levels of savings. For most of those in the high-income group, there was no need to obtain a loan (only 17 % of this group needed loans in 2012). While those households in the low-income group had an increased economic capacity to deal with natural disasters, more low-income households were likely to borrow money from a bank. However, the percentage of low-income households requiring loans declined from 61 % in 2005, to 49 % in 2012.

While the percentage of households doing farming work in the low-income group was slightly lower than that in the high-income group (Table 3), the percentage of households working outside the village in the low-income group was much higher than in the high-income group ( $29 > 19$  %) in 2005. The percentage of households doing farming work in the low-income group was much higher than those in the high-income group ( $47 > 38$  %) in 2012, while the percentage of households working outside the village in the low-income group was lower than in the high-income group ( $34 < 42$  %). The RCFRS influenced the distribution of entire households' labour time. The plan caused households to transfer their farming time to off-farm working time, and especially those workers in the high-income group, both in 2005 and 2012. An analysis of household perception of strategies to cope with unforeseen natural disasters also revealed changes in livelihood strategies. About 52 % of the households in the high-income group and 61 % in the low-income group reported they would borrow money from relatives, neighbours or banks. The second option would be to dip into their savings, but households in the low-income group have little savings to call upon. Only 26 % of low-income

**Table 3** The change in livelihood strategy of high income group and low income group in 2005 and 2012 ( $N_1 = 256$  in 2005,  $N_2 = 337$  in 2012)

Livelihood strategy and its variables	High income group		Low income group		Total	
	2005 ( $n_1 = 109$ )	2012 ( $n_2 = 253$ )	2005 ( $n_3 = 147$ )	2012 ( $n_4 = 84$ )	2005 ( $N_1 = 256$ )	2012 ( $N_2 = 337$ )
1 Types of work						
Farming	62 (57 %)	96 (38 %)	94 (64 %)	39 (47 %)	156 (61 %)	136 (40 %)
Working outside the village	32 (29 %)	106 (42 %)	28 (19 %)	29 (34 %)	58 (23 %)	135 (40 %)
Other types	15 (14 %)	51 (20 %)	25 (17 %)	16 (19 %)	42 (16 %)	67 (20 %)
2 Working hours						
Farming time every year(units: months)	3.8	2.3	4.6	4.1	4.3	1.8
Time of working outside the village every year(units: months)	2.4	8.5	1.6	6.4	1.9	8.0
3 Coping perception of unexpected natural disasters						
Working outside the village	7 (6 %)	68 (27 %)	1 (1 %)	9 (11 %)	8 (3 %)	77 (23 %)
Selling capital	6 (5 %)	3 (1 %)	18 (12 %)	5 (6 %)	24 (9 %)	8 (2 %)
Borrowing money or getting a loan	57 (52 %)	43 (17 %)	90 (61 %)	41 (49 %)	147 (57 %)	84 (25 %)
Dissaving	40 (37 %)	139 (55 %)	38 (26 %)	29 (34 %)	78 (31 %)	168 (50 %)

households had that option, much less than the 37 % of the households in the high-income group.

### *Changes in Livelihood Outcomes*

An analysis of households' livelihood outcomes revealed four major variables to be considered: income, consumption, production environment and households' perceptions (Table 4). With respect to income and consumption, which includes living expenses and productive expenditure, high-income households logically all earned more and spent more than low-income households both in 2005 and 2012. The living expenses of both groups increased between 2005 and 2012. A significant change in both groups was identified as a greater expenditure on their children's education. This in turn resulted in a higher level of education in households of both income groups. Changes in the production environment influenced both living environment and biological diversity on the farms. In this research, households in the low-income group used slightly more pesticides, farmyard manure and firewood than households in the high-income group, both in 2005 and 2012. Due to the high price of chemical fertilizer and their limited economic capability, households in the low-income group appeared to prefer farmyard manure (animal waste) to chemical fertilizers. However, as they always need firewood as the main source of energy with which they warm themselves, the levels of usage of firewood has not changed significantly in seven years. However, it was determined that the heavy forest reliance on firewood would negatively influence the eco-environment surrounding rural communities. It became increasingly important for government and scholars to study how best to supply the energy the households mainly use.

In order to analyze households' attitudes toward the RCFRS, the researchers evaluated and compared the livelihood outcomes with households' perceptions. In 2005, 42 % of households were dissatisfied with their lives, but this number decreased to 21 % in 2012. An increasing number of households in both groups felt the eco-environment improved between 2005 and 2012. Greater proportions of households were more likely to participate in protecting biodiversity because of the potential increase in their financial income (from 46 to 70 %). It could be concluded that households were much more likely to participate in the RCFRS once they had assurances and assistance with their basic living requirements. The second stage RCFRS in Tonggu County began in 2012, and the effectiveness of the preliminary program has been strongly influenced by households' willingness to continue to participate. However, the percentage of households still willing to participate in the RCFRS declined from 90 % in 2005 to 76 % in 2012, even though the program brought real benefits, and especially to those households in the low-income group. No significant changes were recorded in the high-income group. This can be explained by the fact that the economic benefits could not offset the opportunity to retain land the households gave up. Some households in the low-income group felt this loss of opportunity would have a negative impact on their lives, and they therefore become unwilling to continue to participate in the RCFRS.

**Table 4** The change in livelihood outcomes of high income group and low income group in 2005 and 2012

Livelihood outcomes and its variables	Income group and year				
	High income group		Low income group		Total
	2005 ( $n_1 = 109$ )	2012 ( $n_2 = 253$ )	2005 ( $n_3 = 147$ )	2012 ( $n_4 = 84$ )	2005 ( $N_1 = 256$ ) 2012 ( $N_2 = 337$ )
<b>1 Income</b>					
Total household income (RMB)	21,519	52,903	11,232	31,004	16,376 41,954
Net per capita income (RMB)	2,437	4,576	1,290	2,178	1,864 3,377
<b>2 Consumption</b>					
Total household consumption (RMB)	16,843	38,614	12,671	27,606	14,757 33,110
Per capita consumption (RMB)	2,061	4,255	1,479	2,765	1,770 3,510
<b>3 Production environment</b>					
Fertilizer input (kg/household)	430	276	370	266	400 271
Pesticide input (kg/household)	2.4	3.5	2.7	5.8	2.55 4.65
Farmyard manure input (kg/household)	2,934	2,154	3,380	2,799	
Fire wood usage (kg/household)	3,550	2,609	3,872	3,200	3,711 2,905
<b>4 Perception of households</b>					
Better eco-environment (%)	56	85	62	82	59 84
Living a happy life(%)	47	82	38	70	42 79
Willingness to participate in protecting biodiversity (%)	44	69	47	75	46 70
Willingness to participate the reform program continuously (%)	89	81	91	59	90 76

$N_1 = n_1 + n_3, N_2 = n_2 + n_4$ ; Net per capita income is the cash income without entity value, which refers to the income remaining after subtracting the consumption; Quantity of firewood is expressed as dry weight; Perceptions of households are reported as percentages of households

## Discussion

### Level of Dependence on Some Livelihood Capital Assets

According to the data in Fig. 2 and Table 2, households have a strong dependence on some livelihood capital assets. It is reported that households could not rely solely on crop farming to obtain their livelihood objectives, because of the low cost-effectiveness of agribusiness and the decrease of available cropland. In fact, households still put more work and resources into forest land, even though they could gain greater benefits from other livelihood activities (Vanwey et al. 2007; Liu et al. 2010). This situation is also reflected in the following findings: Firstly, crop farming has the highest degree of accessibility among all livelihood activities. With respect to households, a substantial workforce was the basis for this activity, and crop farming was guaranteed by their rich farming experience. There is no doubt that non-farmers may face the threat of natural disasters, but this threat is much lower than for those relying solely on forestry production. Secondly, land is not only the means of production but it is also the subsistence-guarantee. Households felt they could obtain stable and long-term income from forest land. Most rural households cannot obtain a pension at the normal pensionable age, because the rural endowment insurance system has not spread to everyone in China. However, land is the only long-term, stable source of revenue.

### Diversification Strategy for Household Livelihoods

An increasing number of livelihood supporting activities are emerging alongside farming. These other livelihood activities have made increasing contributions to cash income. These activities include jobs particularly working outside the Jiangxi province, Non-farming work in the town, raising livestock and working in orchards. An increasing proportion of the labour force is transferring to non-farming employment as the changed industrial structure. Based on respective assets, households can now choose different livelihood activities autonomously, in order to gain cash income from non-agriculture industries, and also resist the risk from a certain impulsion. Therefore, the households get a basic stable consumption level of income in different seasons. Generally speaking, households choose their respective livelihood strategy based on their livelihood capital assets (Shahbaz et al. 2007; ZhaoXQ and Dai 2010; Yu et al. 2011). Most households, on the other hand, are likely to make a decision which usually combines more than two types of livelihood activities; for example, a combination of agriculture and aquaculture, a combination of agriculture and working outside the village, or a combination of agriculture and working for others in the local town or even running a business.

Theoretically, there are more non-agriculture employment opportunities emerging with improvements in agricultural production, such as the processing handicraft industry, transportation and service industry, all of which give households the opportunity to get more income. In fact, households in this program area always give agriculture particularly commercial crops—a top priority, no matter how rich or poor they are, and no matter what kinds of livelihood activities are available.

This is because all the other potential activities are derived from the main agriculture activities. In addition, livelihood activities can change with their surroundings because they're dynamic. Forestry has made a major contribution to households, because the households can get some program compensation, as well as firewood and construction materials. However, as it is previously stated, this compensation is just temporary and dependent on natural conditions and government policies which could limit the supply of resources. Thus, the forest contribution could create changes in livelihood strategies. Finally, households must adjust their livelihood activities to somehow make up for income shortfalls after the expiry of compensation payments and before the start of a new benefit program. This may require more and more households to work outside the village, or it may mean more intensive cultivation and more ploughing of cropland. Households will have to weigh the risks to their income and to the environment when deciding on the most suitable livelihood activities.

### Contribution of Forestry to Households Livelihoods

In order to reduce the risk to make a living, households choose diverse livelihood strategies which results in a higher complexity of living environment and bring more risk. With the increasing recognition of livelihood activities risks which were neglected at first, households choose to give up outside working which help to accumulate enough money for them and go back to develop. And the major contribution can be divided into three following parts: firstly, forestry provides the basic need for their lives. Households need 10 cubic meters to build a house for their own and some to maintain it according to the local construction costs. Secondly, households could get some compensation as an economic income. They get more income than original agriculture production, because compensation standard the country adopts is higher than the practical production capacity. In addition, some households acquire natural forest product and work on forest as a supplementary strategy which can provide services for environment, such as, water conservation and water and air purification which has been used widely. Local government guides the households to focus on economic forest as a pillar industry such as tea tree and walnut tree in program area.

According to the SLF set by DFID, the contribution forestry made on livelihood has showed in reality inadequately. With the limitation of knowledge and labour conditions, just a few households would go into a mountain to acquire forest product and non-forest product like edible wild herbs, fungi and Chinese herbal medicine which couldn't be got widely. Households never have the chance to read the concept of forest environment service and get the recognition of forest service function at a lower level. Most of them can understand the positive impact of the RCFRS on improving soil and water and protecting environment, while few of them would think about whether the impact get closely related to their own life or not and how closely of the correlation. Besides, forestry has made a lot of direct contributions to livelihood because most of households are participated in the forest reform areas. There is no need to hire more workers to cut massive timber and exploit many

resources. With the exchange labour between relatives and neighbors, households solve the labour shortage problem happened in stages in the program areas.

## Conclusions

The RCFRS has apparently achieved remarkable results for both low and high income households, as well as having positive ecological and economic benefits. It was found that the RCFRS policy did indeed influence the capital assets, the strategies and the overall quality of life of both low-income and high-income households. Changes in access to capital assets remain unbalanced, especially considering the rapid pace of financial capital changes. The primary means of earning a living in the pilot program areas is still agriculture, while for those households, the best way to obtain capital is by working away from their home town. While 76 % of households are satisfied with their current living situation and are willing to participate in the program continuously, only 59 % of the households from the low-income group said they would continue participating in the program. When comparing low-income and high-income groups, it became evident that the unevenly distributed livelihood capital assets of households from the two different groups directly influenced their respective livelihood strategies, and this in turn correlated with changes in the households' incomes. Thus, the RCFRS indeed influences household livelihood conditions and offers households increased income.

The current RCFRS is particularly closely related to ordinary households. It was needed to reconsider some obvious problems. (1) Participation: Regardless of the diversified demands of households, the program weakens the incentive function of the subsidy policy, because the RCFRS has the sole objective of ecological effectiveness. It is forbidden under the program to interplant trees and crops, which has a good effect in the conservation of soil and water in a relatively short time. (2) Long-term impact: the effectiveness of a program could be measured by evaluating the input and output results. What is more, the program's effectiveness can be reflected by its long-term impact. Based on the single goal of ecological recovery, the change in ecological effects is virtually the sole means by which to measure the effectiveness of the RCFRS. The point of importance, however, is how to combine the program's stated goals together with the households' actual development needs. State Forestry Administration (SFA) should clear every expected goal and monitor policy effectiveness in progressive stages by expanding further experience exchanges and establishing cooperation with local government. The establishing staged goals are recommended to relieve the external pressures households face in resisting poverty. Economic development and environmental recovery will drive and stimulate one another, so it is vital to ensure that economic development is not at the expense of the environment, and environmental protection will not cause a serious negative impact on households' livelihoods.

**Acknowledgments** This research was supported by the Innovation Project Fund of Chinese Academy of Social Sciences (Agricultural Resources and Rural Ecological Conservation). We are grateful to Steve Harrison and anonymous reviewers for their constructive suggestions and help with this research.

## References

- Adikhari B, Di Falco S, Lovett J (2004) Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecol Econ* 48(2):245–257
- Ali T, Ahmad M, Shahbaz B, Suleri A (2007) Impact of participatory forest management on financial assets of rural communities in northwest Pakistan. *Ecol Econ* 63(2–3):588–593
- Ballet J, Sirven N, Desjardins-Requiers M (2007) Social capital and natural resource management: a critical perspective. *J Environ Dev* 16(4):355–374
- Barbier EB (2000) The economic linkages between rural poverty and land degradation: some evidence from Africa. *Agric Ecosyst Environ* 82(1–3):355–370
- Blaikie P (2006) Is small really beautiful? Community-based natural resource management in Malawi and Botswana. *World Dev* 34(11):1942–1957
- Carney D, Drinkwater M, Rusinow T, Neeffes K, Wanmali S, Singh N (1999) Livelihoods approaches compared: a brief comparison of the livelihoods approaches of the UK Department for International Development (DFID), CARE, Oxfam, and the United Nations Development Programme (UNDP). DFID working paper, Department for International Development, London. pp 1–10
- Chen HY, Shivakoti G, Zhu T, Maddox D (2012) Livelihood sustainability and community based co-management of forest resources in China: changes and improvement. *Environ Manage* 49(1):219–228
- Cronkleton P, Pulhin JM, Saigal S (2012) Co-management in community forestry: how the partial devolution of management rights creates challenges for forest communities. *Conserv Soc* 10(2):91–102
- Dai LM, Zhao FQ, Shao GF, Zhou L, Tang LN (2009) China's classification-based forest management: procedures, problems, and prospects. *Environ Manage* 43(6):1162–1173
- Grischow JD (2008) Rural community, chiefs and social capital: the case of southern Ghana. *J Agrar Change* 8(1):64–93
- Illukpitiya P, Yanagida JF (2008) Role of income diversification in protecting natural forests: evidence from rural households in forest margins of Sri Lanka. *Agrofor Syst* 74(1):51–62
- Knutsson P, Ostwald M (2006) A process-oriented sustainable livelihoods approach—a tool for increased understanding of vulnerability, adaptation and resilience. *Mitig Adapt Strat Glob Change*. doi:10.1007/s11027-006-4421-9
- Liu C, Lu JZ, Yin RS (2010) An estimation of the effects of China's priority forestry program on farmers' income. *Environ Manage* 45(3):526–540
- Mahdi Shivakoti GP, Schmidt-Vogt D (2009) Livelihood change and livelihood sustainability in the uplands of Lembang Subwatershed, West Sumatra, Indonesia, in a changing natural resource management context. *Environ Manag* 43(1):84–99
- Maryudi A, Devkota RR, Schusser C (2012) Back to basics: considerations in evaluating the outcomes of community forestry. *For Policy Econ* 14(1):1–5
- Pandit BH, Albano A, Kumar C (2009) Community-based forest enterprises in Nepal: an analysis of their role in increasing income benefits to the poor. *Small Scale For* 8(4):447–462
- Schmook B, Radel C (2008) International labour migration from a tropical development frontier: globalizing households and an incipient forest transition. *Human Ecol* 36(6):891–908
- Scoones I (1998) Sustainable rural livelihoods: a framework for analysis. IDS working paper Department for International Development, London. pp 72
- Shahbaz B, Ali T, Suleri AQ (2007) A critical analysis of forest policies of Pakistan: implication for sustainable livelihoods. *Mitig Adapt Strat Glob Change* 12(4):441–453
- Tole L (2010) Reforms from the ground up: a review of community-based forest management in tropical developing countries. *Environ Manage* 45(6):1312–1331
- Vanwey LK, D'Antona AO, Brondizio ES (2007) Household demographic change and land use/land cover change in the Brazilian Amazon. *Popul Environ* 28(3):163–185
- Wang CH, Wen YL, Yang LF (2010) Economic dependence of communities surrounding the giant panda nature reserve on nature resources in the Qinling Mountains. *Resour Sci* 32(4):1315–1322 (in Chinese)
- Wang CH, Wen YL, Duan W, Han F (2013) Coupling relationship analysis on households' production behaviors and their influencing factors in nature reserves: a structural equation model. *Chinese Geograph Sci* 23(4):506–518
- West CT (2011) The survey of living conditions in the Arctic (SLiCA): a comparative sustainable livelihoods assessment. *Environ Dev Sustain* 13(1):217–235

- Xu ZG, Xu JT, Deng XZ, Huan JK, Uchida E, Rozelle S (2006) Grain for green and grain: the impact of China's conservation reserve program on grain prices and food security. *World Dev* 34(1):130–148
- Yin RS, Xu JT (2003) Identifying the inter-market relationships of forest products in the Pacific Northwest with cointegration and causality tests. *For Policy Econ* 5(3):305–315
- Yin RS, Yin GP, Li LY (2010) Assessing China's ecological restoration programs: what's been done and what remains to be done? *Environ Manag* 45(3):442–453
- Yu DY, Shi PJ, Han GY, Zhu WQ, Du SQ, Xun B (2011) Forest ecosystem restoration due to a national conservation plan in China. *Ecol Eng* 37(9):1387–1397
- ZhaoXQ Lv X, Dai JH (2010) Impact assessment of the grain for green project and discussion on the development models in the mountain-gorge regions. *Front Earth Sci China* 4(1):105–116